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Automotive Shop Construction for Public Schools

Bulletin 339

LESTER K. ADE
Superintendent of Public Instruction



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FOREWORD

The constructive suggestions contained in this bulletin are intended to serve as checking points for the school architect and school planner to the end that engineering and architectural details which are important for the satisfactory use of the shop will receive adequate attention early in the planning.

Local conditions will determine to a large extent the selection of equipment, shop layouts, and instruction units to be represented. The shop standards herein indicated represent an ideal situation, to be met or modified as resources permit.

The material has been arranged in its present form by Mr. George H. Parkes, Director of Vocational Education, Williamsport, Pennsylvania, in collaboration with Dr. Walter B. Jones, Chief, Industrial Education, Department of Public Instruction. Many of the suggestions are based on experiences at Williamsport and on observations in other vocational schools.

This bulletin has been written under the direction of Dr. Paul L. Cressman, Director, Bureau of Instruction.

LESTER K. ADE

Superintendent of Public Instruction

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CONTENTS

	Page
Foreword	3
A. The Relationship Between the School Automotive Shop and the Private Service Station	7
B. General Considerations	7
1. Shop Location	7
2. Car Working Stations	8
3. Washrooms and Toilets	8
4. Tool Room	8
5. The Automotive Exhaust	8
6. The Shop Theory Room	8
C. Suggested Building Space Standards	9
D. Building Details	10
1. Drinking Fountain	10
2. Battery Service Sink	11
3. Typical Tool Room Layout	11
4. Suggested Classroom Arrangement	12
5. Wall Inserts	12
6. Types of Fire Extinguishers	13
7. Car Washing Stand	13
8. Sloped Steel Shelving	14
9. Tool Storage	14
10. Battery Charging Station	15
11. Shop Theory Room	15
12. Typical Tool-Holding Device	16
13. Tool Shelf Lighting	16
14. Typical Light Requirements	17
15. Engine Cooling System	18
16. Car Entrance Door Detail	19
17. Tool Room Enclosure	19
18. Service Outlet	20
19. Car Hoist Construction	20
20. Oil and Grease Storage	21

CONTENTS—Continued

	Page
21. Bench Arrangement	21
22. Bench Stand	22
23. Portable Partition Detail	22
24. Bullnose Corner Brick	23
25. Window Stool Detail	23
26. Outside Ramp or Concrete Apron	24
27. Multiple Convenience Outlets	24
28. Oil Dispensing System	25
29. Liquid Fuels Requirements	25
30. Spray Booth	26
31. Car Repair Station Lighting	26
32. Monorail Hoist	27
33. Anchoring Engines for Testing	27
34. Entrance Area Protection	28
35. Wiper Bin	28
36. Automatic Starters	29
37. Arrangement of Utilities	29
38. Power Panelboard	30
39. Minimum Passage for Hand Trucks	30
40. Compressed Air Distribution	31
E. Conclusion	31

AUTOMOTIVE SHOP CONSTRUCTION FOR PUBLIC SCHOOLS

A. The Relationship Between the School Automotive Shop and the Private Service Station.

For vocational industrial purposes, the automotive shop should conform to established practice in private automotive service stations to the maximum extent consistent with the special objective of public education. Since this relationship to industry has certain implications for building planning, the departures from private industry are indicated below:

1. The repair of automobiles must be subordinated to the education of youth. The production jobs are merely a part of the education process.
2. As a rule, the shop must house several times as many persons as a corresponding private service station would need.
3. The school automotive service stations must provide safer and more easily supervised equipment than the private establishment needs for its older and more experienced workmen. In no case should the school shop, however, use miniature, special or otherwise non-productive types of equipment. Everything should be full size and of the best construction standards.
4. The school automotive shop must provide more equipment of a given kind than would be needed in the private shop. This is made necessary by the large number of individuals using the shop.
5. The school automotive shop must be constructed so that a maximum of safety and cleanliness is inherent in the building and equipment.

B. General Considerations

1. Shop Location

By far the best location for a school automotive shop is as a wing or auxiliary building adjacent to, or connected by passage to the main building. The noise, smoke, and dirt, associated with this activity makes its location in the main building undesirable. In general, an industrial type of building, one story, sky-lighted, with from forty-five to sixty feet clear roof span is to be preferred.

2. Car Working Stations

The number of car working stations will depend to some extent on the curriculum and policy of the school. As a general rule, space for one car for every five students in attendance at a given time is satisfactory. A car repair station requires about 250 square feet of floor space.

3. Washrooms and Toilets

Since an important part of the preparation of future service mechanics consists of drill in cleanliness of person and clothing, the toilet room, shower bath, and locker-wash room, should be a part of the shop organization. Wherever feasible, this service suite should be within the shop enclosure and under the supervision of the shop instruction staff.

4. Tool Room

The tool room should be centrally located within the shop. A minimum of fifteen square feet of floor space should be provided. The tool room layout and furniture should be carefully designed for a maximum of cleanliness and for the systematic storage and handling of tools. A storeroom, available to the instructor only, should be provided near the tool room.

5. The Automotive Exhaust

For the maximum use of the school automotive shop, automobiles, and automobile engines must be run indoors at ordinary speed. For the safety of the shop personnel, the engine exhausts must be connected to a positive vacuum system which will draw all gases away. One of the most satisfactory systems consists of conveniently located floor outlets to which flexible conduit can be attached. These outlets, which are of the type usually used for large vacuum cleaning installations, connect to heavy-weight galvanized steel piping beneath the floor. The vacuum is supplied by a blower which exhausts into the atmosphere well above the roof line.

To avoid explosions due to the accumulation of unburned gasoline fumes, fresh air must be admitted to the main exhaust pipe through suitable valves. To reduce the damage from explosions which will inevitably occur, relief valves of the "flapper" type should be installed at the ends of all straight runs and bends. The system should be designed to provide a minimum vacuum of three inches (water) at the floor outlets.

Where the engines are reasonably fixed, as in testing, the exhaust should be connected by means of steel pipe of at least one and one-half inches in diameter.

6. The Shop Theory Room

In a purposeful school vocational automotive program, considerable attention must be given to the specific theory which must accompany and be a part of the shop job. The shop related theory is best taught by the shop teacher, in the shop,

at the time when knowledge of the particular principle becomes important to the shop production job. If this is the school policy, tables and chairs to accommodate twenty-five per cent of the enrolment is desirable.

If the related material policy calls for large group instruction, a classroom large enough to accommodate the maximum shop class should be provided within the shop suite or as close as possible to the shop.

C. Suggested Building Space Standards

Automotive Shop

(Based on Students for Grades X, XI, XII)

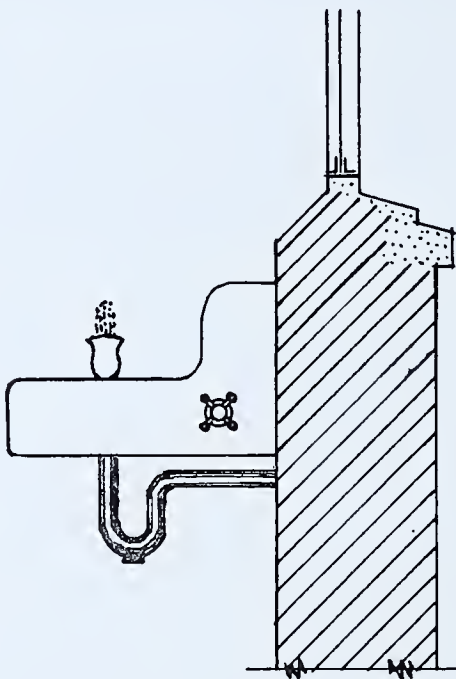
<i>Activity</i>	<i>Approximate Dimensions in Feet</i>	<i>Number of Units</i>	<i>Area in Sq. Ft.</i>	<i>Special Services</i>
Car Stations	25 x 10	4	1000	Air, water, exhaust, portable tool
Tool Room	20 x 15	1	3000	Portable tool
Storage Room	10 x 4	1	40	
Wash Rack	25 x 12	1	300	Air, water, power, portable tool
Shop Theory	20 x 10	1	200	Portable tool
Wash Rooms, Toilets, and Lockers	25 x 20	1	500	As for usual service
Bench Work	10 x 8	3	240	Air, portable tool
Engine Test.....	20 x 10	1	600	Air, water, portable tool, exhaust
Acetylene Welding and Heating	10 x 8	1	80	Exhaust hood, air, portable tool
Spray Booth	25 x 10	1	250	Air, water, exhaust fan, portable tool
Battery Service	10 x 8	1	80	Air, water, hot water, portable tool, acid-proof sink and plumbing
Teacher Station	10 x 6	1	60	Portable tool
Electrical Test	10 x 6	1	60	Air, portable tool
Machine Department...	10 x 8	1	80	Portable tool, power

Note: The activities suggested are not always needed in a given shop. For economy of building space, certain activities may be omitted.

D. Building Details

The following pages contain suggested building and equipment details which have been found in practice to be satisfactory. They are included here so that school planners may use them as a guide while planning the physical structure of the building.

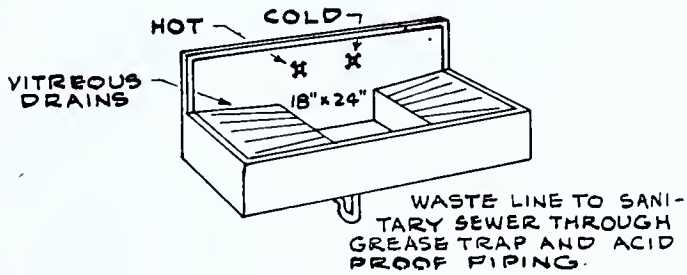
1. **Drinking Fountains**—Are there one or more drinking fountains provided in the shop?



DRINKING FOUNTAIN
WALL TYPE

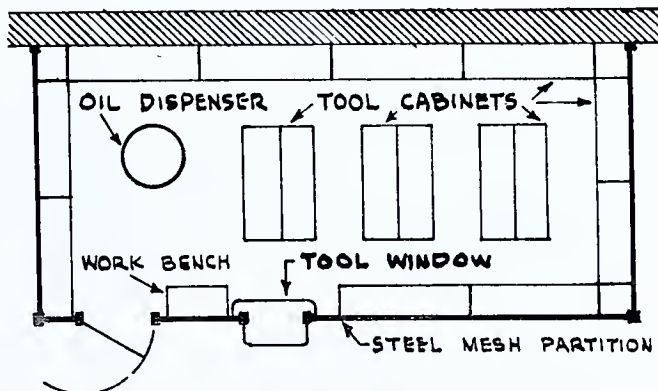
AUTOMOTIVE SHOP CONSTRUCTION FOR PUBLIC SCHOOLS

2. **Battery Service Sink**—Is there a properly designed battery service sink located convenient to the battery service station?



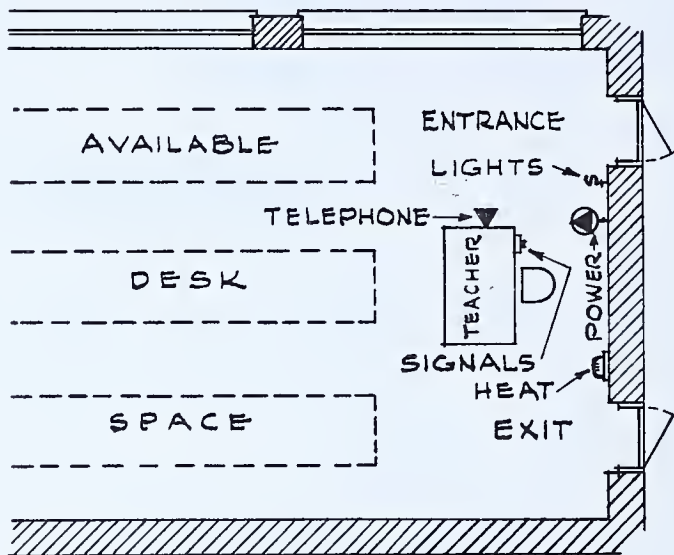
BATTERY SERVICE SINK

3. **Typical Tool Room Layout**—Is there provision for tool keeper repairing tools in spare time?



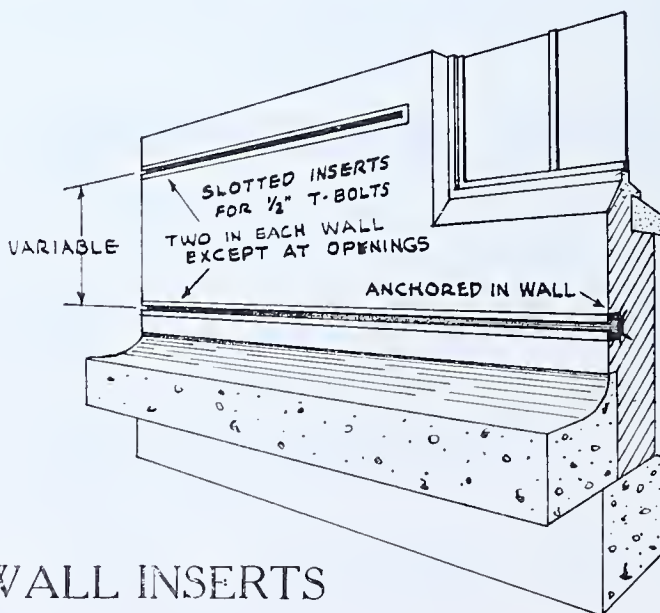
TYPICAL TOOL ROOM LAYOUT

4. **Suggested Classroom Arrangement**—Are entrances and exits so arranged that the teacher can observe all persons entering or leaving the classroom? Are all controls operated near teacher's station to a maximum extent?



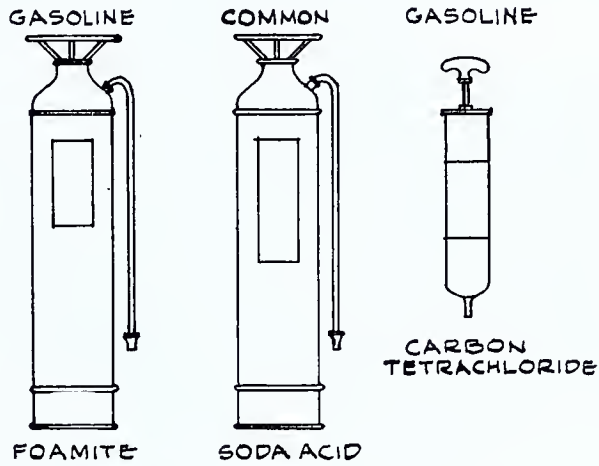
SUGGESTED CLASSROOM ARRANGEMENT

5. **Wall Inserts**—Are there adequate provisions for quickly and securely anchoring equipment and service conduits to walls and ceilings?



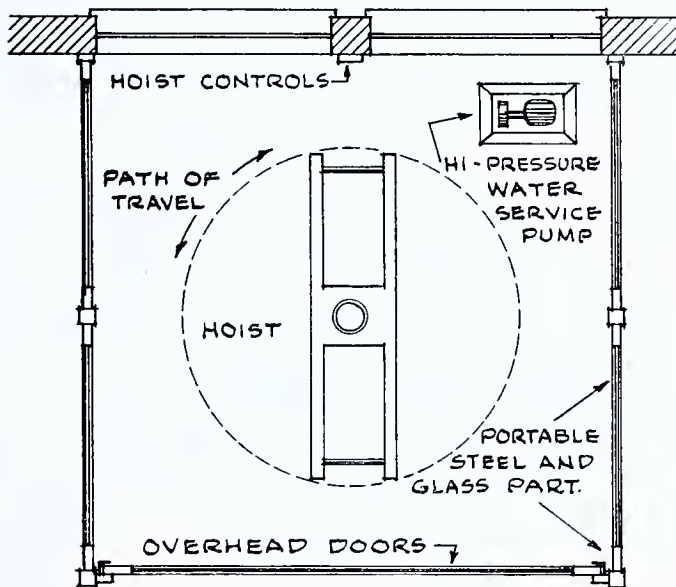
WALL INSERTS

6. **Types of Fire Extinguishers**—Are there provisions for quick emergency fire fighting of gasoline fires?



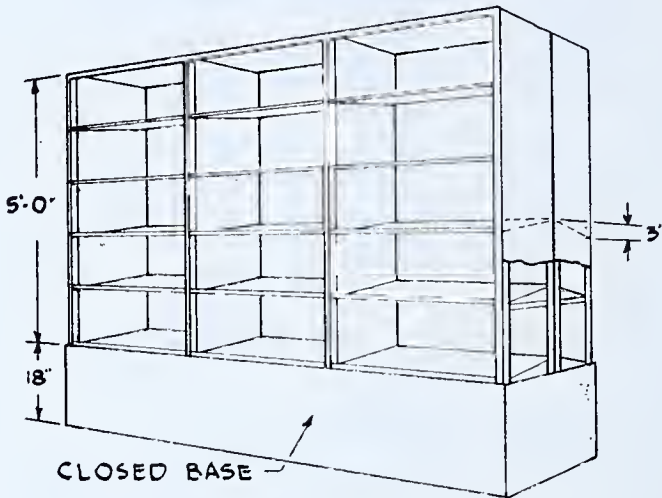
TYPES OF FIRE EXTINGUISHERS

7. **Car-Washing Stand**—Are there provisions for washing automobiles without splashing other portions of the shop?
- Is there provision for high-pressure water service at car-washing stand?



CAR WASHING STAND

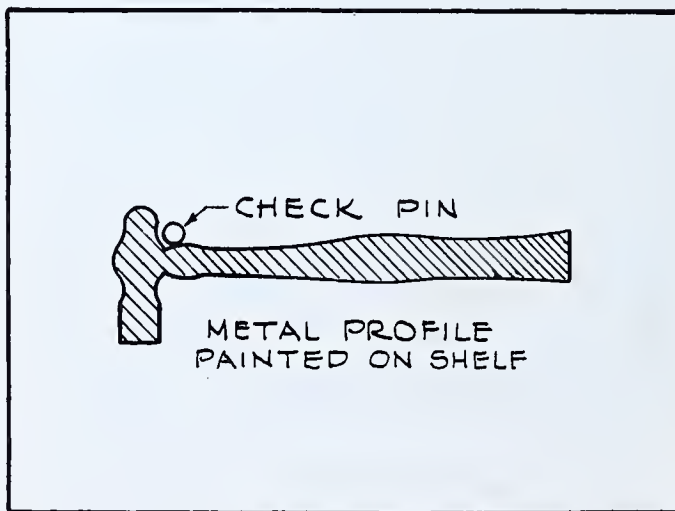
8. **Sloped Steel Shelving**—Are tool room shelves and racks for active tools more than eight and less than five feet from the floor?



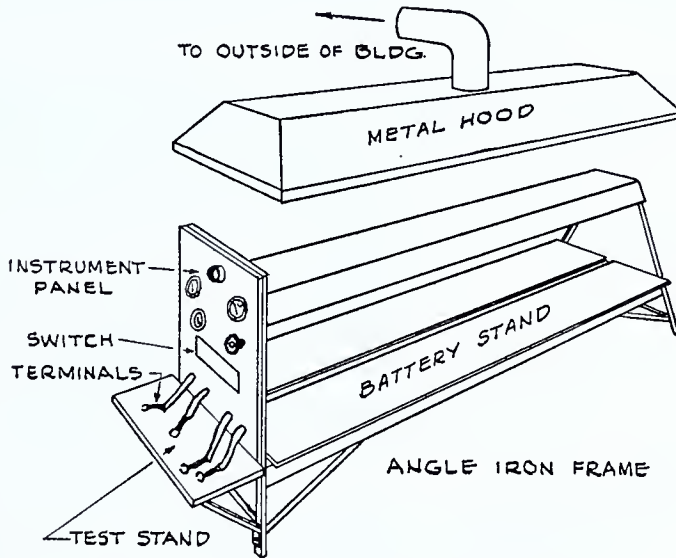
SLOPED STEEL SHELVING

9. **Tool Storage**—Can every tool be removed in one motion and without removing another tool?

Is the tool located so that it is impossible to place the check on the check pin with the tool in place?

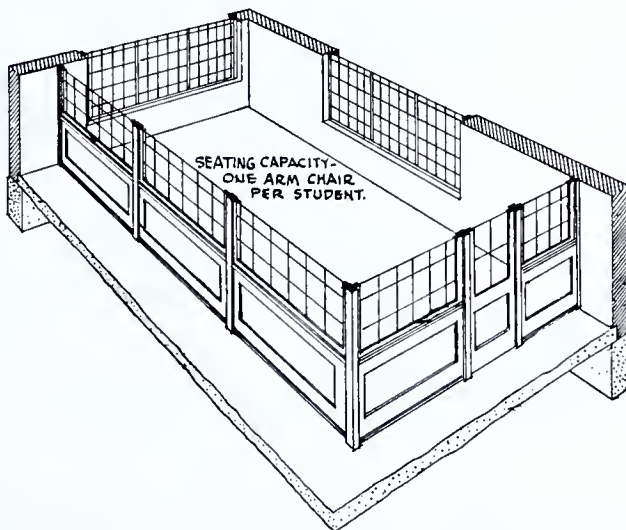


10. **Battery Charging Station**—Does the battery charging bench have adequate ventilating system to prevent fumes from entering the shop?



BATTERY CHARGING STATION

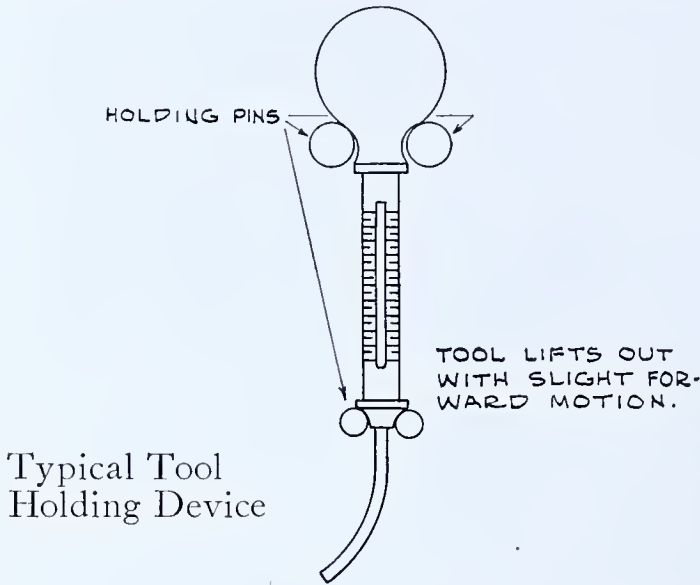
11. **Shop Theory Room**—Is there a theory room or space located so as to be accessible to small shop groups?



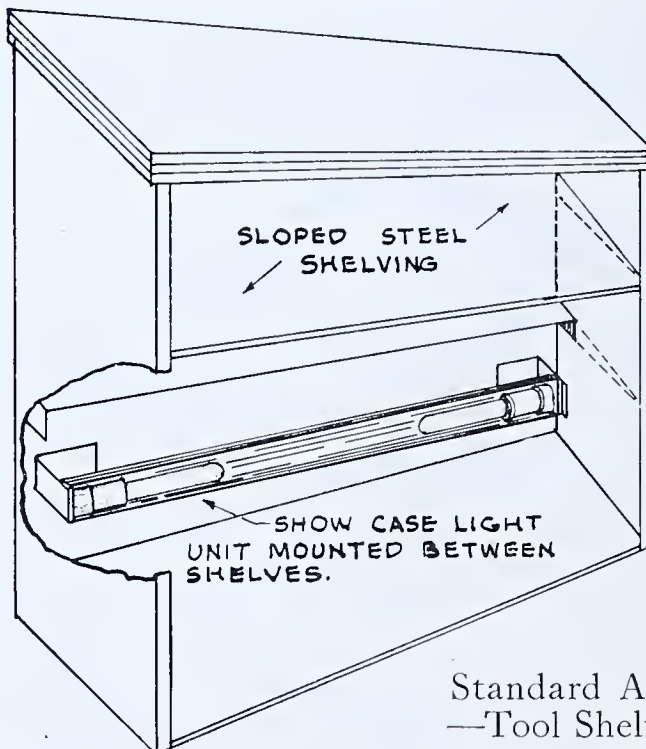
TYPICAL CONSTRUCTION THEORY ROOM

12. **Typical Tool-Holding Device**—Are tool-holding devices arranged so that the tool comes free with a minimum of movement?

Example: A hydrometer, placed sidewise before it is clear of the hole.

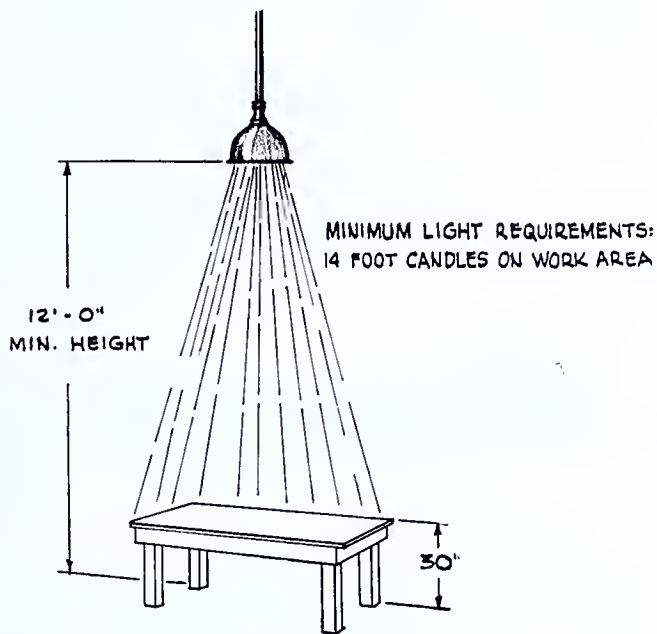


13. **Tool Shelf**—Are tool shelves arranged and equipped so that tools can be lighted by artificial light?



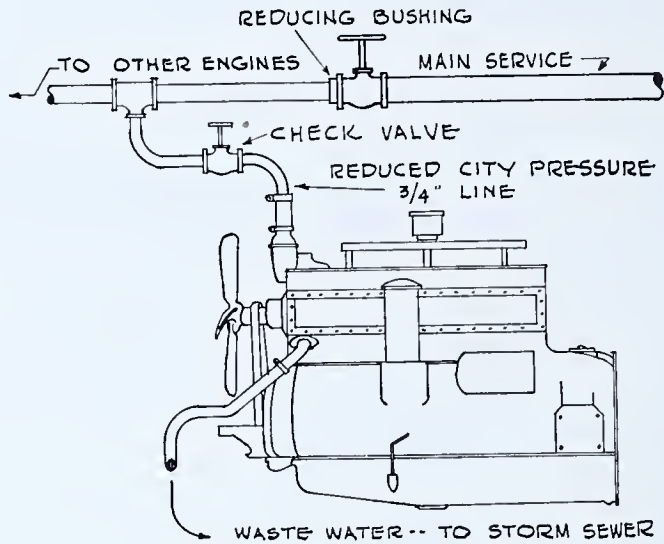
Standard Application
—Tool Shelf Lighting

14. **Typical Light Requirements**—Is artificial general lighting sufficient to give fourteen minimum foot candles on a working place thirty inches above floor?

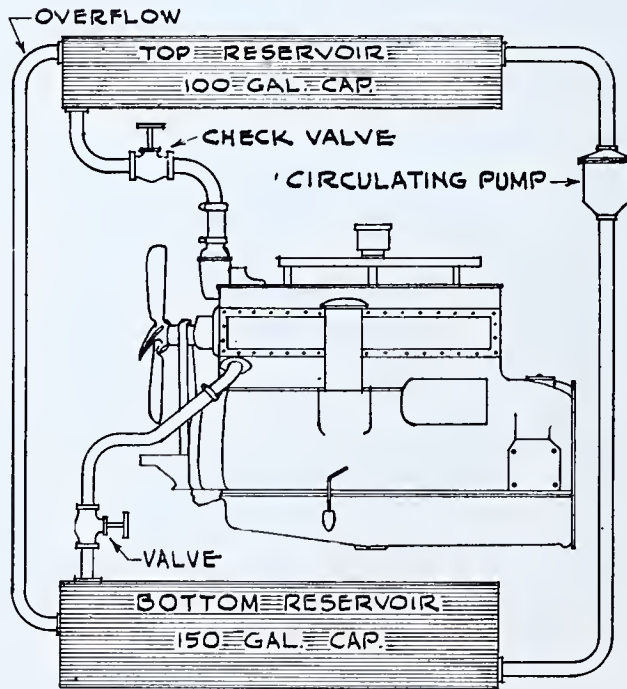


TYPICAL LIGHT REQUIREMENTS

15. **Engine-Cooling System**—Are there provisions for cooling engines on test other than the usual automotive radiator?

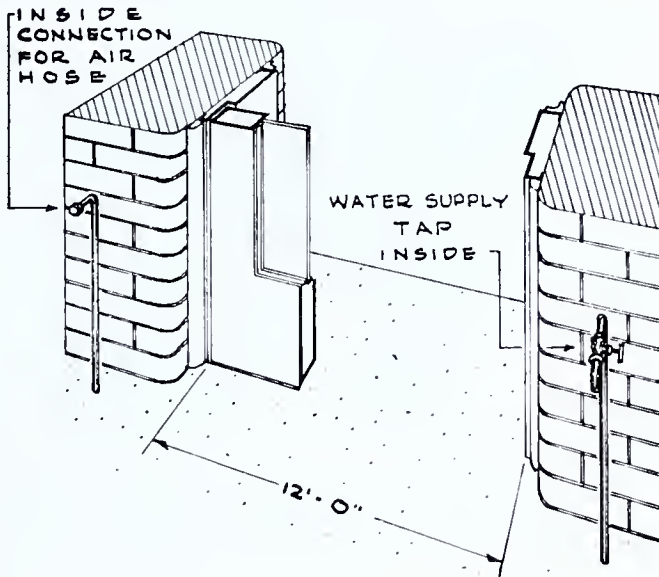


AUTO ENGINE COOLING SYSTEM
PROPOSED WHERE WATER IS ABUNDANT



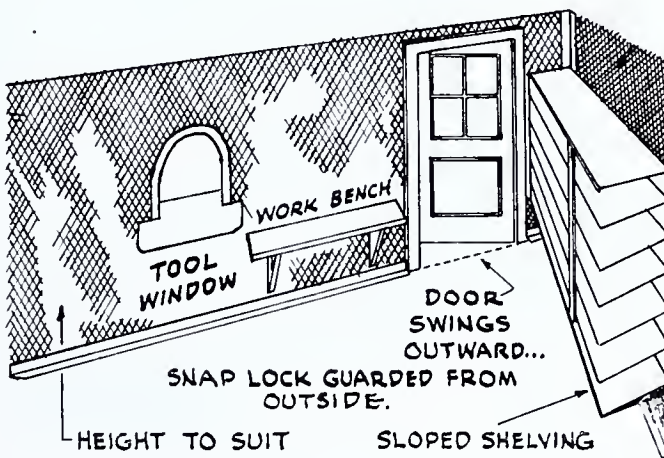
ALTERNATE AUTO COOLING SYSTEM
PROPOSED WHERE WATER IS SCARCE

16. **Car Entrance Door Detail**—Is there an air and water stand for the servicing of cars near the main entrance?



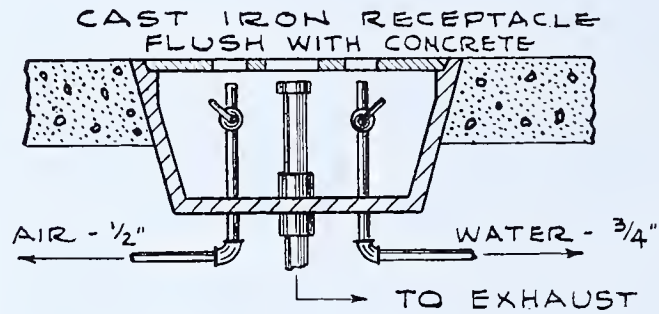
CAR ENTRANCE DOOR DETAIL

17. **Tool Room Enclosure**—Is the tool room enclosure made of first-quality steel and steel mesh units?



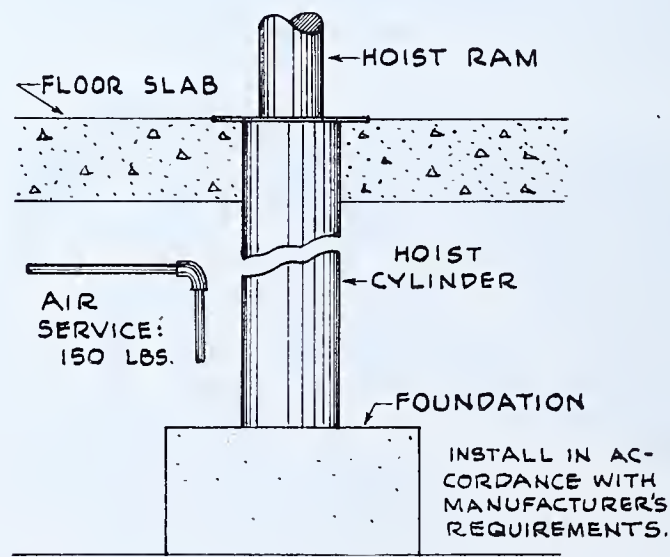
TOOL ROOM ENCLOSURE

18. **Service Outlet**—Is there adequate provisions for the sanitary, safe, and neat distribution of air, water, gas, and exhaust service?



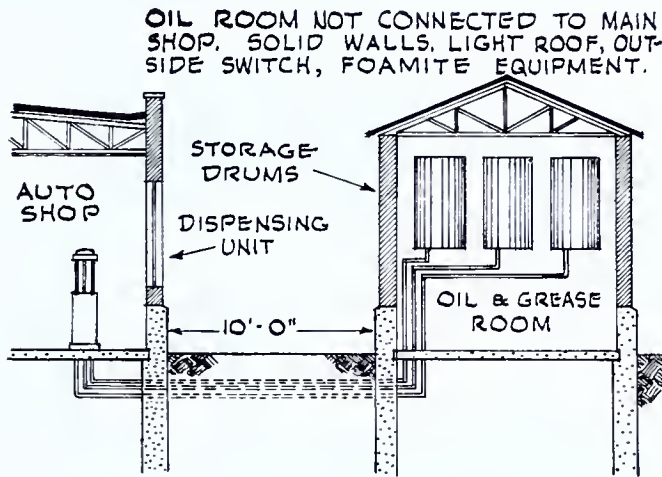
SERVICE OUTLET
FLOOR TYPE

19. **Car Hoist Construction**—Are there provisions in the shop structure for car hoists?



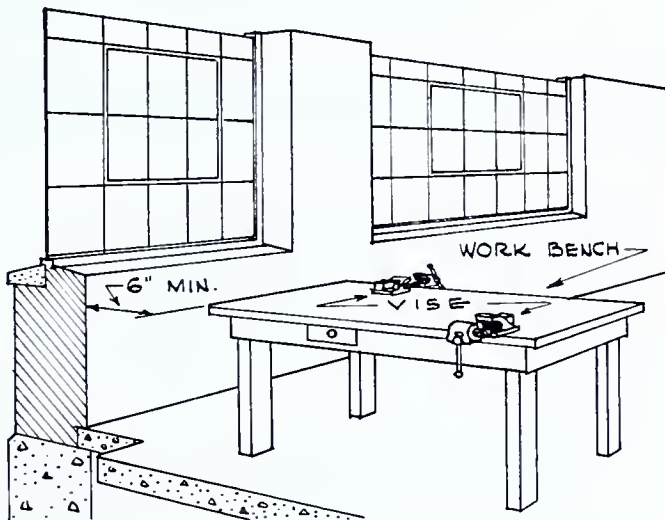
CAR HOIST CONSTRUCTION

20. **Oil and Grease Storage**—Is there a safe and fireproof room for the storage of oils and greases?



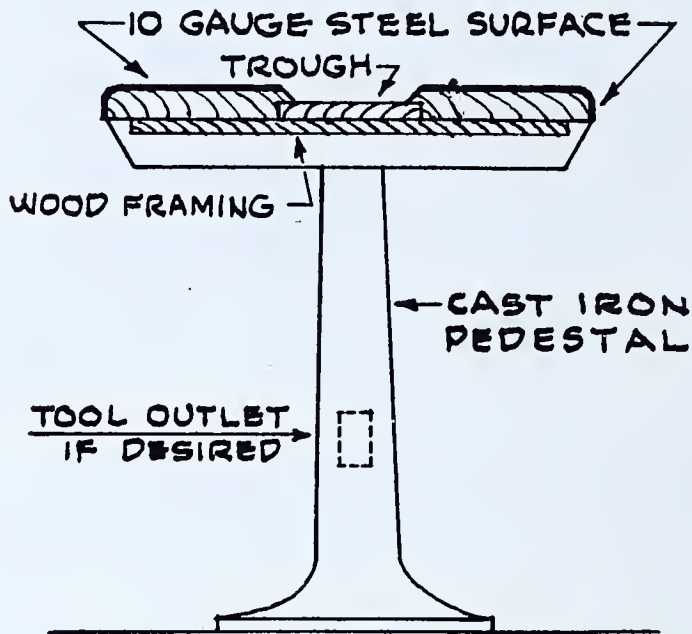
OIL AND GREASE STORAGE

21. **Work Bench Arrangement**—Are benches arranged so that the light is not directly in the eyes of the pupil?



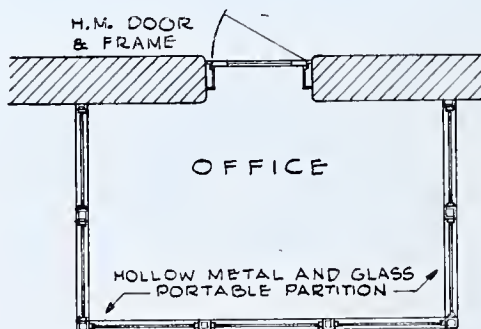
WORK BENCH ARRANGEMENT

22. **Supporting Stand**—Are benches and other pieces of instruction apparatus supported by standards which permit easy and complete cleaning by the usual school custodians or students?



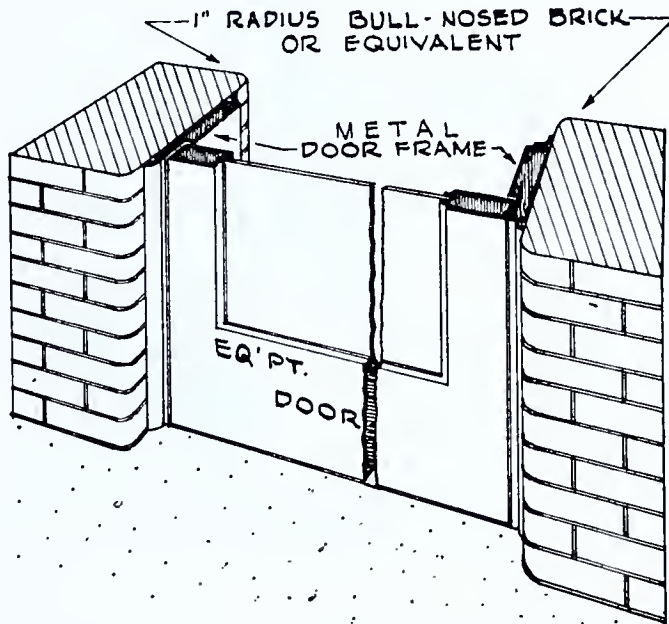
BENCH STAND
PEDESTAL TYPE

23. **Portable Partition Detail**—Are all non-structural partitions movable and subject to relocation as the program changes?



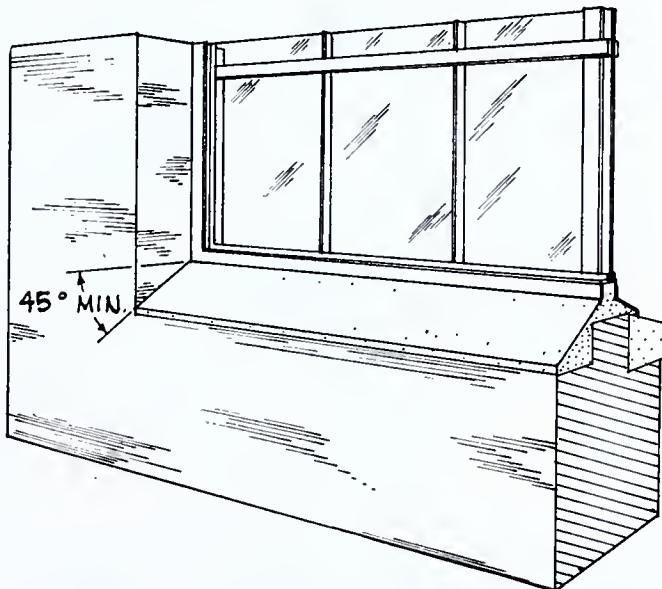
PORTABLE, NON-STRUCTURAL
PARTITION DETAIL

24. **Bullnose Corner Brick**—Are all external corners protected or bull-nosed to prevent chipping by the movement of vehicles or equipment?



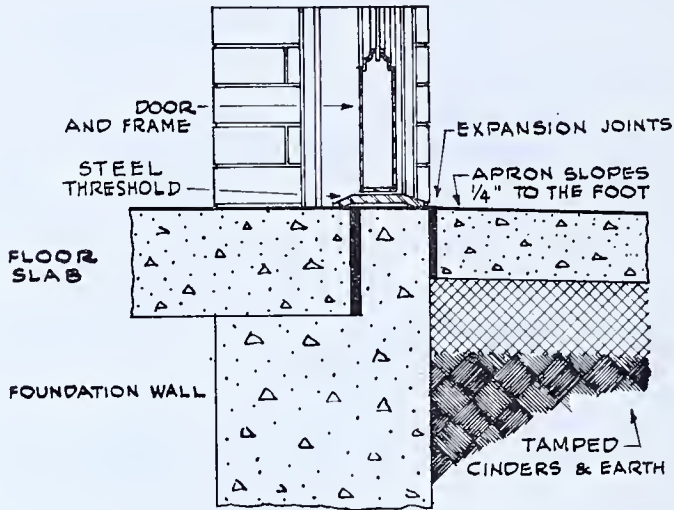
DETAIL - BULL NOSE CORNER BRICK

25. **Window Stool Detail**—Are window sills and other unused exposed surfaces sloped or otherwise arranged so that miscellaneous material will not accumulate?



WINDOW STOOL DETAIL

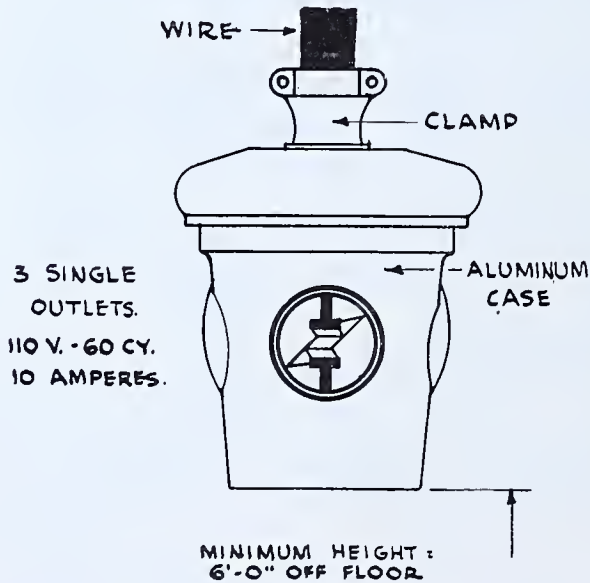
26. **Outside Ramp or Concrete Apron**—Does the ramp or apron leading to car entrance doors slope away from the landing at least one-quarter inch to the foot?



DETAIL OF CONCRETE APRON

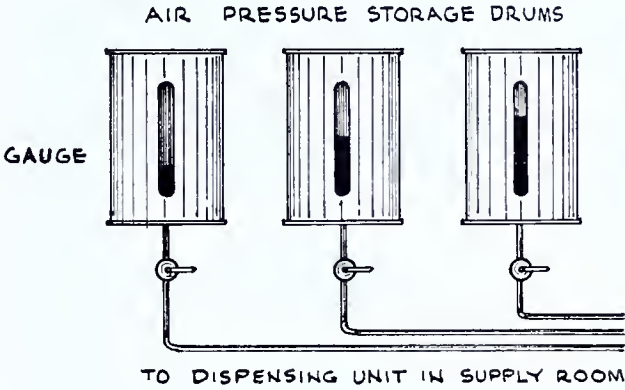
27. **Multiple Convenience Outlet**—Is there a safe and adequate distribution of electric current for portable tools?

Note: Polyphase electric tools, such as electric drills, are much better than the usual single phase type for heavy duty work.



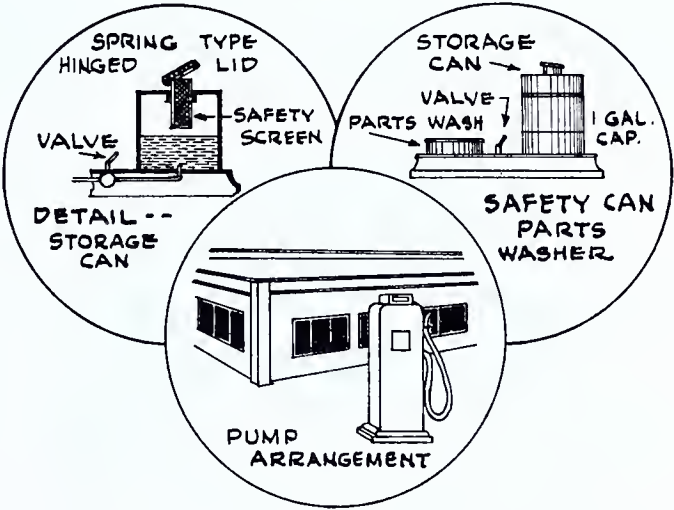
MULTIPLE CONVENIENCE OUTLET
OUTLETS SPACED EVERY 15'-0"

28. **Oil Dispensing System**—Is there adequate system of dispensing oils and greases, safely and according to accepted material accounting standards?



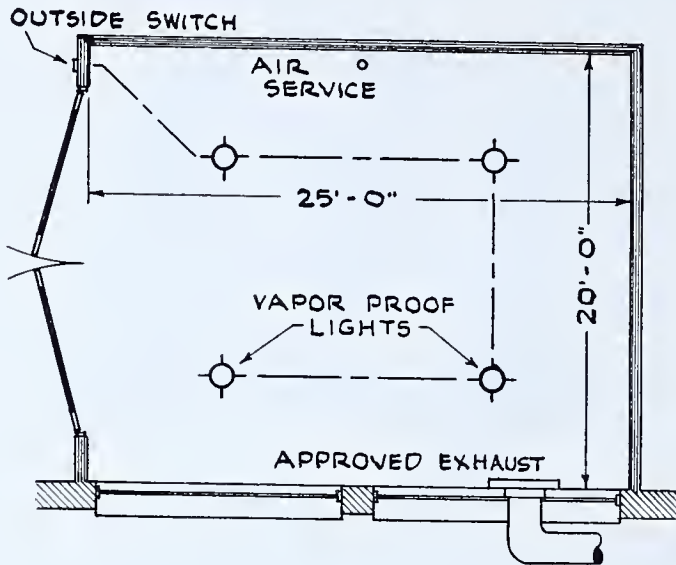
OIL DISPENSING SYSTEM
AIR PRESSURE TYPE

29. **Liquid Fuels Requirement**—Is there proper provision for the safe handling of liquid fuels, as approved by underwriters?



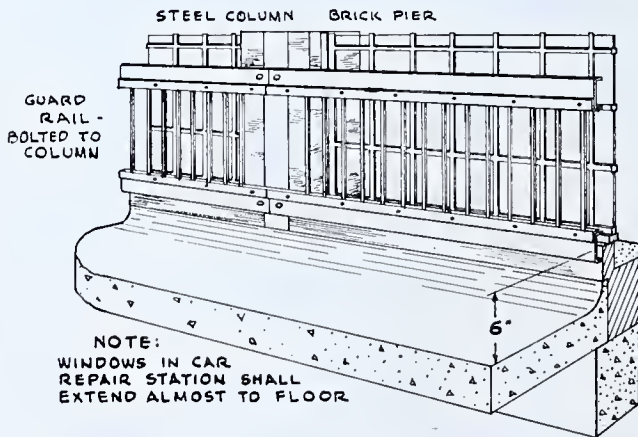
LIQUID FUELS REQUIREMENTS

30. **Spray Booth**—Is there an underwriters approved spray booth capable of handling an entire automobile?



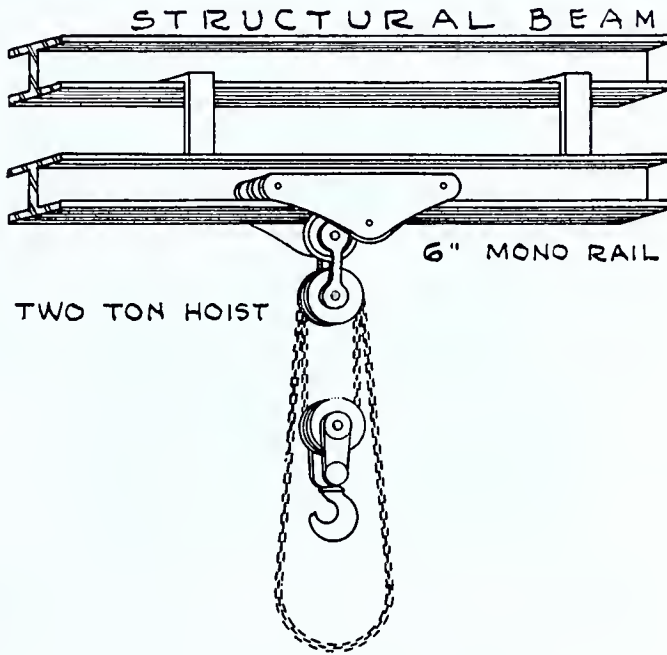
SPRAY BOOTH

31. **Car Repair Station Lighting**—Do windows at car repair stations extend almost to floor level to permit light to pass under cars?



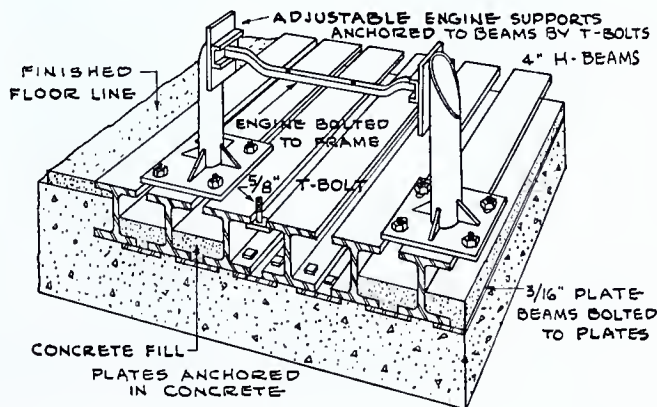
DETAIL - CAR REPAIR STATION LIGHTING

32. **Monorail Hoist**—Is there a satisfactory system of monorail hoists to permit the safe and easy handling of parts?



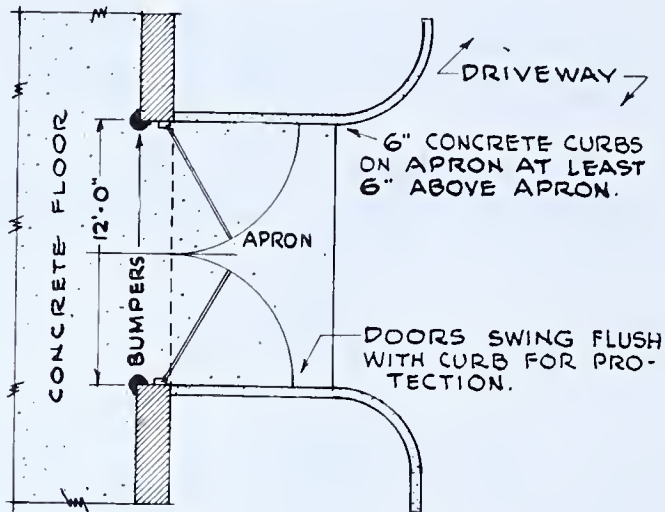
MONO RAIL HOIST

33. **Anchoring Engines for Testing**—Is there provision for universal mounting of engines for testing?



METHOD OF ANCHORING ENGINES
TO FLOOR FOR TESTING

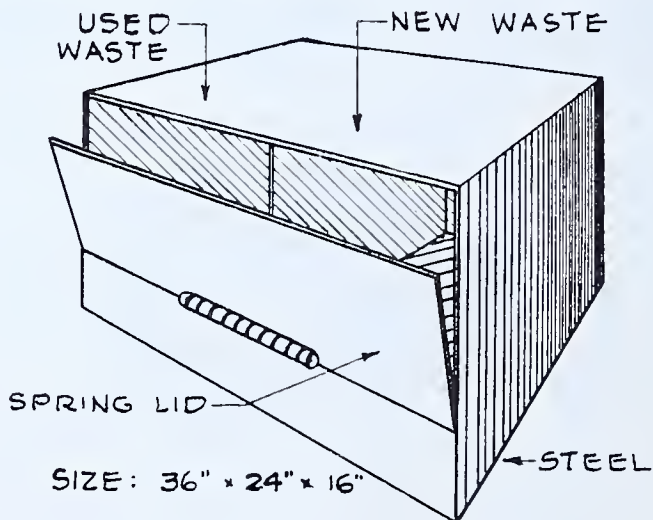
34. **Entrance Area Protection**—Are there adequate door bumpers and other protections at auto entrance doors? Alternate and preferred—overhead doors.



ENTRANCE AREA PROTECTION

OVERHEAD DOORS ARE PREFERRED
WHEREVER POSSIBLE

35. **Wiper Bin**—Is there a convenient and safe place for storing cleaning cloths and oily waste?

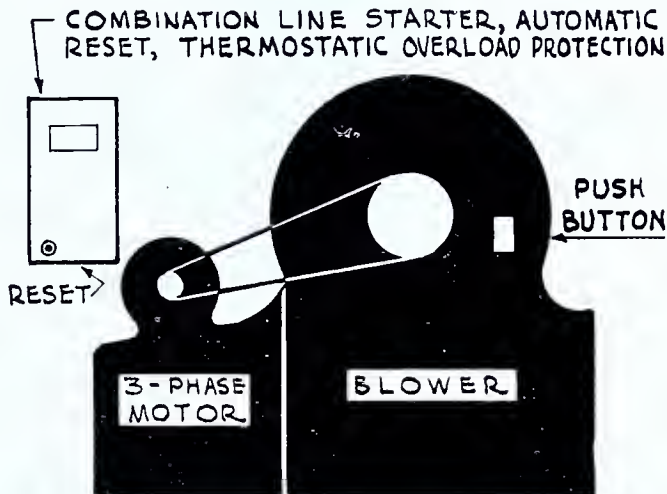


WIPER BIN

AUTOMOTIVE SHOP CONSTRUCTION FOR PUBLIC SCHOOLS

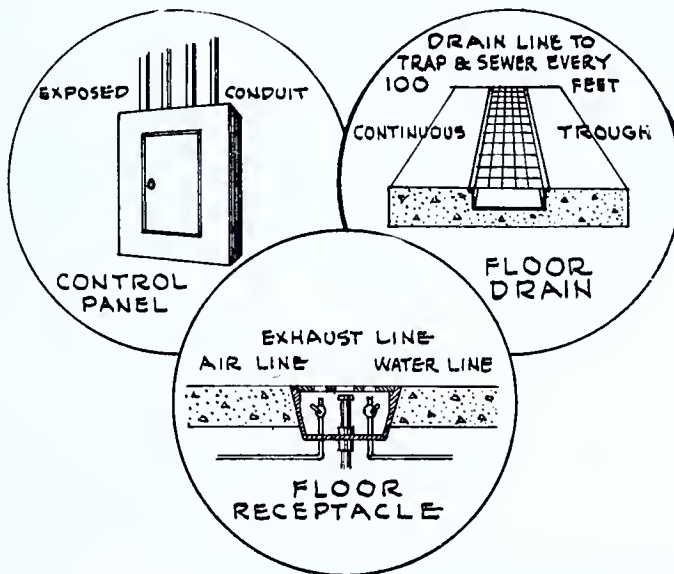
36. **Automatic Starters**—Are all machine tools above one-half with automatic starters and push-button control?

Are motors all of polyphase type, usually 3-phase 60 cycles?



AUTOMATIC STARTER DETAIL

37. **Arrangement of Utilities**—Are all service conduits, wiring, water, gas, air and drains exposed and arranged for removal, alteration or repairs?



ARRANGEMENT OF UTILITIES

